I. Introduction

This subcommittee has been charged with recommending strategies which enable the University to achieve its research, teaching and service mission in the next ten years through the support of necessary administrative information services. In so doing, we acknowledge at the outset that it is very difficult to predict with certainty what technological tools and services will emerge and be available to the University to fulfill its mission in the coming decade. For example, ten years ago in 1998, Google did not exist, iMacs were just being introduced, and dial-up service was a predominant mode of accessing the Internet.

We are more confident in our ability to predict the nature and quality of services required than we are in determining the specifics of technological infrastructure required and attendant growth rates. We will emphasize this qualification at various points in our report.

The members of the subcommittee represent the primary corporate-level stewards of enterprise services, technology systems, and data, along with representatives of the major academic units of the University and their administrative requirements. Our collective common goal is to support students, faculty, alumni, staff and friends of the University with the provision of world-class services leading to their engagement with and commitment to the University.

II. Approach to Committee Charge

The Committee has undertaken a predominantly qualitative approach to its assignment rather than a quantitative or metric based approach. By qualitative, we mean that we have compiled and shared specific visions relevant to our specific areas of service responsibility, and have developed a forecast for what type of technological environment will be required in the next decade. We highlight the number of common infrastructure elements that are required by all of the administrative service units within the University.
We also briefly address the required support for instructional and library technologies to the best of our ability. Because the RACC subcommittee on research is solely concentrating on research matters, we have been asked to incorporate instructional and library support in this report. We would urge the recipients of this report to do additional outreach, survey, and engage more appropriate representatives of the instructional technology and library communities to fully insure that their requirements are adequately described. We have identified needs that we have reason to believe are comparable to the needs we identify for administrative functions. However, we are not expert users of instructional technology or library services, and we are not qualified to express any authoritative opinions as individuals or as a group regarding this mission-critical area. Again, we urge RACC to specifically authorize an additional subgroup to build upon the research and administrative reports.

In fulfilling our charge, we have not expended any significant effort in attempting to forecast specific measures of computing power, energy consumption or space needed due to administrative requirements. Baseline data for the current administrative enterprise computing resources exist; and in other separate initiatives sponsored by RACC, identification of total numbers of computing servers “outside the computing center” firewalls, are already being conducted. Due to the inherently different architectural structure of administrative information systems, the ability to integrate and combine server, storage and support systems across multiple application systems is much greater in the administrative realm, than in the research realm. Therefore, we are leaving the task of translating our visions into computing demand to our technically expert colleagues within NUIT and their consultants. Where we have a basis for making informed judgments regarding the direction of the rate of growth in service demand areas, we will document those judgments.

III. Northwestern University in 2018 – A “360 Degree” World

In 2018, Northwestern will have increased its global presence in its undergraduate, graduate, professional and research programs, and will be supporting a global faculty, staff, student and alumni body.

The University will have modestly expanded enrollment in its permanent, full-time programs, but will have aggressively sought out new enrollment in non-credit, professional certification or other programs that build upon Northwestern faculty expertise, creating affiliation and affinity with Northwestern. The number of applicants enrolling in these programs, and the number of individuals successfully completing these programs, will create an increasing number of individuals who associate with the University in some manner.

The University will continue to emphasize growth in research as measured by numbers of faculty, research faculty, post-doctoral fellows, and graduate students, and increasing the productivity per research team. Research will continue to be
increasingly **interdisciplinary**, with traditional lines of organizational support (singularly through academic departments) becoming more matrix-driven, with exponential increase in the number of administrative units supporting specific research initiatives. Also, the University will be involved in greater collaboration with other institutions, and this must be supported in a more efficient and effective manner.

The *competition* for the highest quality faculty, students, staff will continue to be intense. There will also be competition for the attention and engagement of our alumni. The University must meet expected service levels as determined by those services available in the commercial marketplace, and comparability to those of our higher education peers. The “front face” of technology is a critical success factor in the recruitment and retention of these important constituents.

The University must support a **highly mobile** workforce, where access to the core services necessary to conduct the work of the University must be provided from any location in the world via multiple device types and software utilities. This will involve supporting more flexible work arrangements for faculty, staff and students. This more dispersed workforce will need to be supported by a centrally maintained and standardized framework, with on-line training, collaboration, calendaring, messaging and communication tools, which will enable the community to conduct its work in a secure and effective manner. The workforce should not be dependent upon department, unit or school based infrastructures or services in certain core areas that prevent them from fully engaging university services.

Individuals who affiliate with Northwestern will be **identified** by their role and responsibility with the University. They may hold multiple roles and responsibilities, and may have multiple levels of affiliation throughout their relationship with the University, which may last for their lifetime. Administrative functions within the University need the ability to “see” that individual in the entirety of their relationship with the University. This is a characteristic of “360 degree” capability.

The University’s **instructional and library needs** will increasingly be dependent upon greatly expanded networking and storage capacities in order to transmit and store media of all types, support the creation and distribution of new curricular and instructional materials, support the global search and acquisition of such materials through consortial and inter-institutional arrangements, and provide the infrastructure necessary to also provide access to materials resident at Northwestern.

The University’s current **compliance-intensive** legal and regulatory framework will become more intrusive and restrictive.
The cumulative impact of these changes can be translated into a judgment that the University will experience processing power growth in a range of 5-7% annually over the next ten years. The rate of growth in data storage requirements, however, is expected to be in the range of 15-20% annually, and is particularly dependent upon certain policy outcomes related to the control of institutional data that are outlined further below. It is also expected that there will continue to be regular updates of existing enterprise software platforms that are adding new functionality and services.

IV. Technology Infrastructure: An Outlook from 2008 - 2018

To fulfill the “360 degree” vision of the University in 2018, it must now begin, in 2008 to improve its technology infrastructure to include the following elements:

1) System access with **24x7** availability for administrative system to support global operations, with Tier 3 back up support and redundancy to assure maximal “uptime”. Provide redundant failover capabilities on all critical enterprise systems (Financials, HRIS, SES, AIMS), which allows the ability to have as narrow maintenance windows as possible when systems are not available, as well as the ability to enable complete application functionality replication in business continuity scenarios. (The University’s current data center capacity limitations require that certain mission critical functions are not able to be restored in disaster scenarios.) Provide budgetary support for sufficient staff and software tools that enables system maintenance on a “rolling” basis so that it is not necessary to concentrate maintenance in one window of a week, month or year. Tools that enable more sophisticated automated monitoring are also important.

2) Provide improved **identity management** services so that the provisioning of service access to authorized users is done in a secure and timely fashion, at the same time as providing highly effective network protection and detection services to prevent unauthorized access from occurring. An individual associated with the University endures through time, and may have a variety of roles, organizational affiliations, and responsibilities during their association. This is especially true in the support of research and the health care environment. However, it is equally a challenge in supporting the “360” view of an individual, to not only protect information from unauthorized use, but also to permit access to information that is necessary for an administrative service or function to be effective in the service of that individual. The identity management infrastructure must be robust, secure and managed at an institution-wide level, and not be solely focused at either the entry-point of a person’s affiliation or be assigned to a specific organizational unit at a point in time. It should be administered at an enterprise-wide level. Appropriate numbers and quality of staff must be retained to monitor, maintain, and utilize these services.
3) Provide robust, integrated workflow engines that can support multiple authorization paths across enterprise systems, built upon role access for each authorized person in the University. Strive to have as few workflow engines as possible across applications in order to reduce maintenance costs and risks.

4) Provide an integrated collaboration and document management system, accessible and adaptable to multiple application uses, in order that the work of the University can be done electronically, and essential University documents necessary for audit, compliance, legal, regulatory or institutional use, are stored in a consistent, indexed and retrievable manner. There needs to be support for authorized, auditable access to documents necessary to conduct the University’s work, as well as create an archived repository of critical institutional records.

5) Provide additional disaster recovery capabilities through management of appropriate storage and recovery of mission critical institutional data from locations geographically remote from Evanston and Chicago.

6) Provide an integrated, secure environment for messaging and collaborating within the University community and intersecting globally with the world-wide web. Email, text, collaboration and scheduling tools, along with other means of communicating should be supported by standardized supported devices and software services so that there is only one official repository of official University documentation.

These elements above represent services and support that are not being done today at a level or with a degree of integration that would be able to support the 360 vision of 2018. However, to move beyond the current less-coordinated approach to infrastructure requires very intentional institutional planning, investment and implementation.

7) In this regard, in order to assure that infrastructure planning is appropriate and cost effective, there needs to be a commitment to supporting a technology governance process that integrally tied to the University’s strategic priorities and vision. In turn, a process grounded in strategic principles then enables a linkage to multi-year and annual resource allocation plans, assuring that the necessary resources are provided to support the desired environment.

Here are some examples from our peers of strategic decisions reflecting a University’s “values” which have clear implications for their technology infrastructure:

1) MIT’s determination that all of its curricular material shall be deemed free and open to the world, and the requirement that faculty post their curricula on the web. This decision has tremendous implications for standardization of tools to access the curricula, for storage, for authorization and usage tracking, and for management of the material itself.
2) The University of Chicago’s recent decision to expand its storage for its library collection on its campus due to a belief that it should be accessible in the closest possible way to the core of its campus.

3) Peer universities who have made decisions to maintain email and other messaging infrastructure within their universities, due to their evaluation of their unique institutional needs.

These are not “right or wrong” decisions. These are decisions where the institution has declared a set of priorities that derive from their evaluation of business objectives, and then work to create a technology infrastructure that supports those objectives. The importance of establishing an improved governance structure cannot be overstated. When there is greater engagement and transparency, there is greater mutual accountability – and greater accountability results in more cost effective investment decisions for the people, resources, and facilities that are necessary to support a University’s priorities.

A specific example in the Northwestern environment that has been highlighted in our discussions is the provision of greater enterprise system support at the school or administrative unit level (below the layer of the enterprise.), so that we’re not only leveraging the major investments in core systems, but also avoiding the extra costs of adaptation at the unit or school level. The concept of “software as a service” should be explored for internal deployment in order to avoid costly investments in staff and applications that are derivative of enterprise systems. This will help in establishing greater consistency, security, and standardization which will aid in greater effectiveness in delivering services to faculty and students. This is why the deployment and support of Cognos and a data warehouse application remain very high priorities among the Northwestern community. Deployment of these tools in a standardized way is the greatest way to improve quality of decision-making and lower the cost of information management throughout the University.

It is understood that what must accompany planning, investment and execution are the creation and enforcement of policies that allow the work of the university to be done in a cost effective and secure manner. Examples of such policies would be:

- document retention guidelines
- personal use of University email
- standards regarding types of devices permitted on network
- ownership of University work
- maintenance of business continuity plans
- support of integrated systems such as workflow, collaboration and document management
- guidelines for determining budgetary responsibility for provision of infrastructure (“behind the wall”, hardware, software)
- guidelines for schools or divisions with documented requirements that are not satisfied by the enterprise solutions; who pays? Who controls?
- Transparency in costing and pricing policies for core services

V. Potential for Outsourcing

Virtually any system or technology service is capable of being outsourced, including the “core” data center that is the subject of this review. The critical first step in any evaluation of outsourcing is the commitment to a planning and evaluation process that is framed from a strategic business point of view. What relationships and services does the University want to fully control because of their relationship to the university’s core business? This contrasts with evaluating relationships and services over which the University is willing to have less control in order to gain some other compelling objective, such as flexibility or cost savings. This is the key issue – and it drives to the heart of how the University wants to manage the relationship with its faculty, students, staff and alumni. What parts of this relationship does it want to own, and which parts does it not? This is a far-reaching set of issues, and we should work to develop a means of engaging these issues in a standardized way, workable for Northwestern, in an improved governance process. Disciplined systematic and continuing review of these factors will yield much more refined and accurate planning forecasts regarding processing power and data storage requirements. In turn, this will enable predictable resource planning requirements, including what level of investment is required on a sustainable basis to meet expected demand.

VII. Conclusion

We have appreciated the opportunity to represent the administrative community at Northwestern in articulating a vision for technology infrastructure. Our recommendations are ambitious, achievable and affordable, if executed with careful, integrated planning. If we anchor our efforts by linkage to the University’s strategic objectives, and dedicate ourselves to continual consultation, engagement, and adaptation, we are confident that Northwestern will create the blueprint it requires to guide its long-term investment planning in data center infrastructure.